

UNIT 4 LIFELINE SYSTEMS AND FACILITIES

UNIT 4 – LIFELINE SYSTEMS AND FACILITIES

Overview

In this unit we will use the process and procedures from Unit 2 show the participant how to fill out the evaluation forms for lifeline systems and facilities including: airports, bridges, geotechnical, pipeline, pumping plant, reservoir, roads, wastewater treatment plants, and water treatment plants.

Training Goal

Participants will know how to use the evaluation forms in conducting safety evaluations of various lifeline facilities.

Objectives

Upon completion of this unit, participants will be able to: complete the evaluation forms and report their recommendations on the conditions of the lifeline system or facility.

4.0 Lifeline Systems and Facilities

The lifeline systems and facilities discussed in this unit form a critical part of a community's infrastructure. For that reason, **only detailed evaluations will be performed**, and evaluators who have professional training and/or experience in the design and operation of the systems will perform the assessment. It is well beyond the scope of the SAP to teach the concepts and philosophy that are utilized in design of these systems.

Because of the nature of the systems involved in these evaluations, the jurisdiction is encouraged to assign someone from Public Works, Police, or Fire to accompany the SAP team. Information on the condition of many of these systems needs to be conveyed to the proper authorities immediately so the appropriate actions can be taken. For example, a bridge on a main street through the jurisdiction that is deemed to be unsafe needs to be taken out of service immediately. Having a jurisdiction representative with the team allows the information to be transferred to the appropriate department rapidly.

In this class, we will familiarize you with the forms and how to fill them out. The American Society of Civil Engineers, Los Angeles Chapter developed these forms for use by the Governor's Office of Emergency Services in the late 1970s as the Safety Assessment Program was first being developed. These evaluations are not damage assessments and, like building evaluations, are intended to determine the safety of lifeline systems or facilities for continued use. The evaluations are sufficient to determine if a system or facility is safe enough to return to service (INSPECTED or "Green"); should be returned to service with some restrictions (RESTRICTED USE or "Yellow"); or taken out of service until repaired (UNSAFE or "Red").

Only one of these forms, the bridge assessment, has been used in an actual response. This was during Loma Prieta in the City of Santa Cruz. Therefore, as these forms are used in actual assessments, we can assume that they will go through an improvement process similar to the ATC-20 forms.

In Unit 2 we learned that in accordance with the ***Post-Disaster Safety Assessment Plan***, the goal of the Safety Assessment Program is:

- **To get as many people as possible back into their buildings as quickly and safely as possible.**

We must also look at **rapidly restoring vital services that will impact the public at large**, as well as the emergency response. In this unit, we will look at the evaluation forms that will be used for critical infrastructure aimed at rapidly restoring vital services and arteries for the movement of resources around the effected area.

The lifeline systems and facilities that are a part of the Safety Assessment Program include:

- Geotechnical Evaluation (applicable to all)

- Transportation Systems
 - Airports
 - Roads
 - Bridges
- Water/Wastewater Systems
 - Pipeline
 - Wastewater Treatment Plants
 - Pump Station
 - Water Treatment Plants
 - Reservoir

The evaluations that will be performed are classified as detailed evaluations and the placards are the same as the placards used for buildings. When posting placards, care must be taken to use the correct placard for the conditions noted. Posting of facilities will be discussed in detail at the end of the unit.

4.1 Assessment Form Heading

Facility Name: _____ Address: _____ County/City _____ Mo/Day/Yr ____/____/____ Time ____ <div style="text-align: right; font-size: small;">use 24 hr</div> Type of Disaster _____	SAP ID Nos. _____ Other Reports _____ No. Photos ____ No. Sketches ____ Ref. Dwgs. _____ Est. Damage % _____ Facility Status <div style="border: 2px solid black; width: 150px; height: 30px; display: inline-block; vertical-align: middle;"></div>
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SAFETY INSTRUCTIONS: The possibility of the presence of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard. **ALSO:** The FAA is responsible for checking and evaluating damage to control tower equipment, lighting controls, communication systems, navigational aids, and approach light systems. Obtain permission from tower to enter runway. Permission obtained from _____

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. **REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION.** The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None <input type="radio"/>	Recommended: Green <input type="radio"/>	Posted at this assessment: Yes <input type="radio"/>
Green <input type="radio"/>	Yellow <input type="radio"/>	No <input type="radio"/>
Yellow <input type="radio"/>	Red <input type="radio"/>	
Red <input type="radio"/>		

All of the lifeline systems forms use the same header, including the geotechnical report. Therefore, the discussion through Section A of the forms will be done once before going into details of each system form.

"Facility Name," "Address," and "County/City" are self-explanatory. The facility name should be the name provided by the jurisdiction or used by the jurisdiction during day-to-day operations. "Address" is the street address as used by the jurisdiction. "County/City" should be the name of the county or the city depending on who has jurisdiction over the facility or system. "Mo/Day/Yr" refers to the date of the evaluation that is being performed and the "Time" is the time of day the evaluation was performed. Please note that time should be shown using the 24-hour clock. Finally, the "type of disaster" is a reference to the event that caused the need for the evaluation. For example this could be an earthquake, flood, wildland fire, etc. The actual name of the event, if known, could be used.

To the right of the form is the section that identifies who did the evaluation and what supporting documentation was used to develop the assessment. On the first line, the evaluators would enter either their SAP identification number from their ID Card or their names. The jurisdiction responsible for the evaluation will establish their criteria in relation to using names or ID card numbers. As was discussed in Unit 1, originally this was a liability issue and, since liability has been resolved in multiple ways, there is no problem in using the evaluator's name. "Other Reports" relates to safety assessment evaluations or any other type of report that was used in the performance of your assessment. If no other reports were used, indicate "NONE." If other reports were used, indicate "OVER" in the available space and list the reports by title or assessment number.

"No. Photos" relates to the number of photographs that are a part of this evaluation. "No. Sketches" relates to the number of sketches you developed as a part of the assessment. If photographs were taken and/or sketches developed, they need to be stapled to this assessment report. If the photographs require developing, the film should be turned over to the jurisdiction. If the photographs are digital, they need to be downloaded into the jurisdiction's computer system.

"Ref. Dwgs." refers to any drawings that were used in the assessment. If none were used, indicate "NONE" in the available space. If drawings were used, note "OVER" and list the drawings by drawing number on the back of the form.

Unit 2 discusses providing estimates of the damage seen. If you are comfortable estimating the percentage of damage, you may enter it in the space marked "Est. Damage." As Evaluators, do not be overly concerned about providing precise estimates. This information is used by the jurisdiction to assist them in determining the impact of the disaster. These numbers are very preliminary and will change many times before the actual repair work is done.

The final block is "Facility Status." In the large box provided, simply indicate by color the recommended status of the facility as a result of this assessment.

The next two sections provide a safety reminder to the evaluator and a caution statement to the jurisdiction. The first part of the safety reminder applies to all evaluations, while the second portion of the reminder applies only to airports. The caution statement reminds the jurisdiction that the level of assessment you are performing is not sufficient to be used in countering any other engineering opinions that have been developed through more in-depth and thorough evaluations.

Section A of the evaluation is where you indicate what the existing condition of the facility or system was prior to your assessment (i.e., previous assessment where this is a re-evaluation). In the

"EXISTING" section check the box that was the recommendation from the previous assessment. If there is no recommendation, or you do not know if another assessment had been performed, check the "NONE" box. The "Recommended" portion of the box is for noting the condition that you are recommending based on your assessment. Again, check the box with the appropriate placard color. The final box is simply a notation of whether or not you physically posted the facility or system following your assessment. In most cases, for these systems, you will not place a placard.

The first page of the form is intended to provide the jurisdiction with a quick overview of the condition of the facility or system. All pertinent information regarding the posting used is contained on the first page. In the remaining sections of this unit, we will look at each form beginning with Section B.

4.2 Geotechnical Evaluation



(Photograph by Robert A. Eplett, California OES)
Figure 4-1 – Surface Faulting - Landers/Big Bear Earthquake, 1992

Within this unit, the geotechnical evaluation is the only non-lifeline specific assessment. In this case, a geotechnical evaluation can be requested for any type of facility or assessment where damage has occurred or been exacerbated by soil conditions. Most geotechnical evaluations will be performed on facilities that have already had a facility specific evaluation. Where the forms do not explicitly note geotechnical conditions, it is hoped that the previous evaluation team has noted on their assessment forms the conditions that lead to their recommendation for a geotechnical assessment. This will give the new team a starting point to begin their assessment. The assessment begins at the site in question, and expands outward to determine if subsurface or surface soil conditions pose a threat to the continued use of the facility or system.

Geotechnical failures, particularly liquefaction and associated lateral spreading, have many times caused the most severe damage to lifeline facilities. Pipelines, tanks, and foundations built in or on soil that liquefies move with the soils laterally, settle, or become buoyant. Movement results in severe damage. Liquefaction is most often found adjacent to water bodies where the groundwater table is high with unconsolidated soils. Settlement not related to liquefaction can also occur, although usually is not as severe. Landslides sometimes occur where there is steep topography.

A copy of the evaluation form can be found on the following page.

STATE OF CALIFORNIA SAFETY ASSESSMENT PROGRAM GEOTECHNICAL EVALUATION

Facility Name _____	SAP ID Nos. _____
Address _____	Other Reports _____
Co-City-Vic _____	No. Photos _____ No. Sketches _____
Mo/Day/Yr ____/____/____ Time _____ use 24 hr.	Ref. Dwgs. _____
Type of Disaster _____	Est. Damage % _____
	Facility Status

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. **REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION.** The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None ☐ Recommended: Green ☐ Posted at this assessment: Yes ☐
Green ☐ Yellow ☐ No ☐
Yellow ☐ Red ☐
Red ☐

B. RECOMMENDATIONS

Monitor _____
Other _____

C. COMMENTS

	0	1	2-3-4	5	6	NA	NO
Damage Scale:	None (0%)	Slight (1-10%)	Moderate (11 - 40%)	Severe (41 - 60%)	Total (over 60%)	Not Applicable	Not Observed

Observed Condition	Extent of Condition D.O.	Effect of Condition D.O.	Observed Condition	Extent of Condition D.O.	Effect of Condition D.O.
Ash flows	_____	_____	Flooding	_____	_____
Avalanches	_____	_____	Landslides/mudslides ..	_____	_____
Collapsed soils.....	_____	_____	Lava flows	_____	_____
Cut.....	_____	_____	Liquefaction	_____	_____
Differential settlement..	_____	_____	Lurching	_____	_____
Displacement.....	_____	_____	New springs	_____	_____
Dried springs	_____	_____	Ponded water	_____	_____
Erosion	_____	_____	Sand boils	_____	_____
Faulting	_____	_____	Tsunami/seiches	_____	_____
Fill	_____	_____	Soil shear failure	_____	_____

E. CONTINUING HAZARDS TO LIFE/PROPERTY (Please describe)

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

4.2.1 Filling Out the Geotechnical Evaluation Form

1. **Recommendations** – Many times, damages will be found that on the surface may not be significant enough to take the facility or system out of service. However, over time these damages can become more significant. In this section of the form, the evaluator will note the areas of the facility that need to be **monitored** on some regular basis. Ideally, the evaluator will indicate what needs to be monitored, why, and at what point the condition will cause a change in the posting or the need for another action. The second part of this section allows the evaluator to provide information about the posting decision that would be pertinent for the jurisdiction to know. This section can also be used to elaborate on monitoring requirements.
2. **Comments** – This space is used to provide explanation on any part of the assessment that the evaluator believes needs to be explained. If there is not enough room to write the necessary explanations, simply indicate "OVER" at the bottom of the form and continue on the back side of the form.
3. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.
4. **Section D – Observed Geotechnical Conditions with Effect On Facility** – Utilizing the DO, the evaluator will look at all the conditions and describe the extent of the condition. This allows the jurisdiction to understand how bad the geotechnical conditions are at the site. The second part of the assessment describes the impact of that condition. Remember, the two evaluations can have significantly different assessments. For those areas that are not involved in the event (i.e., ash flow for an earthquake event) use the designation NA (Not Applicable).
5. **Section E – Continuing Hazards to Life/Property** – The evaluation team will use this section to verbally describe the conditions at the site that may be a hazard to life safety and to property. This narrative should go into some level of detail relating the geotechnical conditions to the original posting of the facility or structure. Remember, you are not performing an engineering evaluation, so your narrative needs to be commensurate with the assessment performed. Mapping the area that has liquefied showing the size of cracks, location of sand boils, and an estimate of lateral movement is useful, if time permits.

4.2.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended posting. If the facility has been posted with a placard, make sure you update the existing placard with the appropriate information. If your recommendation changes a posting from INSPECTED to RESTRICTED USE or UNSAFE, or from RESTRICTED USE to UNSAFE, change the placard and add the appropriate information explaining the change in condition. If the geotechnical conditions you observe do not have an impact on the site or facility, DO NOT change the existing placard. If there is a comment on the placard regarding the potential hazard from the geotechnical condition, make the appropriate change and add your names to the placard with the new date and time.

4.3 Airports



The large international airports will not be using the SAP to obtain evaluators to assess the safety of the airport for continued use. Because of the volume of traffic at these airports, they will utilize their own engineers to perform the evaluations within minutes following the occurrence of an event. Evaluators from the SAP will be used to evaluate the small, general aviation airports that are located within the community. These will become key facilities for the purpose of receiving and moving resources for the community. In some cases, these airports will also be used as staging areas for the people and equipment that will be assisting the community.

(Photograph from the Denali Collection)

Figure 4-2 – Airport Runway, Lateral Spreading

There has been a wide range of earthquake damage to airport facilities. Liquefaction and/or settlement have occurred on runways, rendering them inoperable. Control towers have been damaged because of the seismic amplification occurring between the ground and the roof. Roof structures on control rooms are often damaged because of the poor support provided by the glass walls. Emergency power is often not operable because of the failure of batteries required to start generators, and/or failure of other support systems required to operate the generator.

4.3.1 Filling Out the Airport Evaluation Form

A copy of the evaluation form can be found on the following page.

1. **Recommendations** – Many times, damage will be found that on the surface may not be significant enough to take the facility or system out of service. However, over time these damages can become more significant. A good example would be a cracked runway from an earthquake. Additional aftershock activity may increase the size of the crack or, in the worse case, begin to separate vertically. In this section of the form, the evaluator will note the areas of the airport that need to be monitored on some regular basis. Ideally, the evaluator will indicate what needs to be monitored, why, and at what point the condition will cause a change in the posting. The second part of this section allows the evaluator to provide information about the posting decision that would be pertinent for the jurisdiction to know. This section can also be used to elaborate on monitoring requirements.
2. **Comments** – This space is used to provide explanation on any part of the assessment that the evaluator believes needs to be explained. In the case where the airport may be posted RESTRICTED USE, it is in this section that the evaluator would note the restrictions. If the airport is to be posted UNSAFE, the reasons for that choice are provided here.

C. COMMENTS

	0	1	2-3-4	5	6	NA	NO
Damage Scale:	None	Slight	Moderate	Severe	Total	Not	Not
	(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

D. SURFACE DISPLACEMENT			G. REMARKS
	D.O.	Amount in inches Horiz. Vert.	
Runway pavement			
Taxiway pavement			
Aircraft aprons			
Car parking areas			
Access roadways			
Bridges			
Liquefaction			
(Bridge Report Attached <input type="checkbox"/> Geotechnical Report Attached <input type="checkbox"/>			
E. UNDERGROUND UTILITIES			
		D.O.	
Water mains			
Water services			
Gas mains			
Sewer			
Collapsed <input type="checkbox"/>			
Displaced <input type="checkbox"/>			
Large storm drains			
Aircraft fueling systems			
Airfield lighting			
Underground electrical			
F. BUILDINGS			
		D.O.	
Control tower structure			
Passenger terminal buildings			
Structural			
Mechanical			
Electrical			
Utility plant buildings			
Equipment			
Piping			
Emergency generator building			
Equipment			
Fuel supply			

3. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.
4. **Surface Displacement** – This section is used to note the vertical and horizontal displacements of various portions of the paved areas of the airport. The first line is to indicate the level of damage using the damage scale. The second and third lines are to record the actual displacements at the time of the assessment. There are times when runways will cross over streets; these overpasses are considered as bridges, and the structure should be evaluated using the Bridge assessment form. The same would apply for pedestrian bridges or overpasses.
5. **Underground Utilities** – For each of the utilities listed, the evaluators will estimate the level of damage using the damage scale. Each of these utilities, if individually damaged, could be grounds for a recommendation of a RESTRICTED USE posting. For example, if the sanitary sewer has failed, the damage may not be sufficient to consider the airport unsafe. However, you do not want people using the restrooms until the sewer is fixed, especially if the airport is being used as a staging area. Your restriction in this case would be to close and lock all restrooms due to the sewer damage.
6. **Buildings** – For each of the buildings, either a Rapid Evaluation or Detailed Evaluation form should be filled out. The results of that assessment will provide the background information for determining the approximate level of damage here. Each building assessment form should be stapled to the airport evaluation form.
7. **Remarks** – This section lets you expand in some detail the results of the assessment of the various components. Further, this is a good place to cross-reference to either the bridge or building evaluation forms if used.

4.3.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended posting of the airport. Once determined, the team should report to the general manager of the airport and relay to them what their recommendations are. Remember that you do not have the authority to post the airport; all you can do is make a recommendation. When you return to whoever assigned you to assess the airport, provide them with your recommendations and as much detail as you can. When your recommendation is to post the airport UNSAFE, you must immediately contact the jurisdiction representative with your recommendation. If the airport does not have a general manager or someone in charge, the jurisdiction will notify the FAA, which will put out a general broadcast indicating the airport is closed.

4.4 Bridges



Olympia, WA, April 18, 2001 — The 4th Street Bridge was severely damaged during the February earthquake. A temporary bridge is being built to take traffic over the river while a new, permanent bridge is built.

FEMA News Photo

(Photograph courtesy of FEMA)

Figure 4-3 –Olympia, Washington, Nisqually Earthquake, 2001

The major bridges throughout the state are found on the highways and freeways, which are a part of the national highway system. CalTrans will evaluate these bridges immediately following the event. However, the SAP can be used to provide engineers to evaluate bridges that are not a part of the national highway system located within the jurisdiction. These bridges will be important to the jurisdiction for moving resources to where they are needed. SAP engineers evaluated bridges in the City of Santa Cruz following the Loma Prieta Earthquake. This has been the only experience with the forms to date.

Bridges are damaged when support columns (without adequate confinement steel) fail in shear, unable to transfer lateral loading to their foundation. Bridge spans fall off abutments

and piers if the seat is too narrow, and they are not otherwise restrained. The most vulnerable bridges are those with multiple spans and those that are at an angle to the obstruction they cross. Bridge approaches sometimes settle, resulting in an offset at the abutment.

4.4.1 Filling Out the Bridge Evaluation Form

A copy of the evaluation form can be found on the following page.

1. **Recommendations** – This section shows the typical types of recommendations that would apply to bridges, though not necessarily the only ones. Upon completion of the assessment, your overall recommendations are noted here by checking the appropriate boxes. If the monitor box is checked, make sure that you note in the comments the conditions that need to be monitored and the criteria. Also, include some form of threshold when another action should take place. For the other boxes, add information in the comments section when appropriate. If the shore and brace box is checked, you should note a location. If there is not enough room for all the comments, simply note "OVER" at the bottom of the form and continue on the back side.
2. **Comments** – This space is used to provide explanation on any part of the assessment that the evaluator believes needs to be explained. In the case where the bridge may be posted RESTRICTED USE, the evaluator would note the restrictions if they are not checked off in the recommendations section. If the bridge is to be posted UNSAFE, the reasons for that choice are provided here.
3. **Bridge Description** – In this section of the evaluation form, the evaluator will describe the structural system of the bridge, configuration of the bridge, and description of the foundation system. In the spaces where dimensions are requested, these should be either estimated or "paced." Do not take the time to physically measure by tape or chain all the dimensions requested.

STATE OF CALIFORNIA SAFETY ASSESSMENT PROGRAM BRIDGE

Facility Name _____
Address _____
Co-City-Vic _____
Mo/Day/Yr ____/____/____ Time _____
use 24 hr.
Type of Disaster _____

SAP ID Nos. _____
Other Reports _____
No. Photos _____ No. Sketches _____
Ref. Dwgs. _____
Est. Damage % _____
Facility Status

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None ☐ Recommended: Green ☐ Posted at this assessment: Yes ☐
Green ☐ Yellow ☐ No ☐
Yellow ☐ Red ☐
Red ☐

B. RECOMMENDATIONS

Monitor _____ ☐ Use for emergency vehicles _____ ☐
Use for public transportation _____ ☐ Close to truck traffic _____ ☐
Use for pedestrians _____ ☐ Use for private passenger vehicles only _____ ☐
Use for two-way traffic _____ ☐ Use for one-way traffic _____ ☐
Use off-site detour _____ ☐ Use for on-site detour _____ ☐
Use underpass only _____ ☐ Use overpass only _____ ☐
Barricade _____ ☐ Shore and brace _____ ☐

C. COMMENTS

D. BRIDGE DESCRIPTION

1. <u>Type</u>	MATERIAL					3. <u>Internal support</u>	Number of spans			Height (ft)
	Concrete Prestr.	Steel Reinf.	Composite	Timber			One	Two	No.	
Arch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Bents (frames)	<input type="radio"/>	<input type="radio"/>	_____	_____
Box	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Columns	<input type="radio"/>	<input type="radio"/>	_____	_____
Cantilever	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Piers	<input type="radio"/>	<input type="radio"/>	_____	_____
Girder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
Slab	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	4. <u>Abutments</u>	High	_____ ft.		
Suspension	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>		Low	_____ ft.		
Truss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	5. <u>Road Dimensions</u>	Length	_____ ft.		
							Curb to curb	_____ ft		
2. <u>Foundation:</u>	Caisson	<input type="radio"/>	Pile	<input type="radio"/>	Spread footings	<input type="radio"/>	Walks	_____ ft		

DAMAGE OBSERVED (D.O.)

	0	1	2-3-4	5	6	NA	NO
Damage Scale:	None	Slight	Moderate	Severe	Total	Not	Not
	(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

E. FOUNDATION

D.O.

_____ Earth movements/gaps

Piles at:

_____ a) abutments

_____ b) Piers

Spread footings at:

_____ a) Abutments

_____ b) Piers

F. ABUTMENTS

_____ Disturbance or erosion

_____ Wall movement (_____in)

_____ Backfill settlement (_____in)

G. WINGWALLS

_____ Damage

☐ Movement

☐ Separation

H. APPROACHES

D.O.

_____ Damage

☐ Operational

☐ Roadway settled (_____in)

☐ Off bridge seat

I. BEARINGS

_____ Integral

_____ Contact

_____ Rocker

_____ Elastomeric Pad

J. INTERMEDIATE SUPPORTS

_____ Settlement

_____ Damage

☐ Near top

☐ Near bottom

☐ Near middle

☐ Moment failure

☐ Shear failure

☐ Compression failure

☐ Support lost

K. SUPERSTRUCTURE

D.O.

_____ Girder

☐ Shear cracks

☐ Moment cracks

_____ Deck

☐ Long. joints enlarged

☐ Expansion joints

_____ Truss

☐ Upper chord

☐ Lower chord

☐ Diagonals

_____ Suspenders

L. GEOTECHNICAL

_____ Liquefaction

_____ Landslide

_____ Faulting

_____ Other

REMARKS

4. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.
5. **Sections E through L** – These are the individual components of the bridge structure and should be assessed in turn. For each component, estimate the level of damage using the damage scale. For areas not seen use the NO (Not Observed) rating. Remember, as with buildings, you are not to perform destructive investigation. You will rate only what you can see by walking around, over, and under the bridge. Keep in mind safety – do not imperil yourself if the bridge is in imminent failure. In Section L, if any one of the noted conditions exists, a geotechnical evaluation should be requested. This can be noted in the remarks section.
6. **Remarks** – This section lets you expand in some detail the results of the assessment of the various components. As with the comments section, if there is not enough room, simply mark "OVER" at the bottom and continue on the back side of the form.

4.4.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended posting. If it is determined that the bridge is so seriously damaged that it needs to be posted UNSAFE and removed from service, the jurisdiction representative with you should be told immediately. They, in turn, will contact either Public Works or the local Police Department to ensure the proper actions are taken. If you do not have a jurisdiction representative with you, use the list of contact numbers provided to you, and call the individual who assigned the bridge to you to report your findings and recommendations. In the case where recommendations are not time sensitive, wait until you return to your staging area to pass on your recommendations. Bridges, like most lifeline systems or facilities, will not be physically posted. The placards are too small for motorists to safely see and understand what the placard says. Barricades are the most likely method to be used for closing bridges.

4.5 Roads and Highways



(Photograph courtesy of FEMA)

Figure 4-4 – Road Settlement, Northridge Earthquake, 1994

Like bridges, you will be used to evaluate local streets. Freeways and highways that are a part of the national highway system are rapidly evaluated by CalTrans. Local streets are very important to the jurisdiction, as they are used to transport resources throughout the jurisdiction. As evaluators, remember that local law enforcement and fire are on the streets immediately following the event. Very quickly, they will determine what streets are useable and which are not. You could expect that streets and roads would be some of the last lifeline systems to be formally evaluated. A good example of the type of evaluation would be where the local law enforcement has closed a street and re-routed traffic around the area. As the emergency response period winds down, they need to open those streets as quickly as possible.

Roads can be made impassable (in addition to bridge collapse) as a result of geotechnical failure, or collapse/debris from buildings and bridge overpasses. Roads constructed on liquefiable material can break up, particularly if lateral spreading occurs. Landslides can either cover roads with debris, or the road itself can move. Following the Kobe Earthquake in Japan, and the Coalinga Earthquake in California, debris from collapsed buildings limited emergency response, in particular their ability to respond to fires.

4.5.1 Filling out the Road and Highway Evaluation Form

A copy of the evaluation form can be found on the following page.

1. **Recommendations** – This section shows the typical types of recommendations that would apply to roads, though not necessarily the only ones. Upon completion of the assessment, your overall recommendations are noted here by checking the appropriate boxes. If the “Monitor” box is checked, make sure that you note in the comments the conditions that need to be monitored and the criteria. Also include some form of threshold when another action should take place. If the “Traffic in danger due to adjacent unstable/unsound structure” box is marked, make sure you describe the condition in the comments section. If there is not enough room for all the comments, simply note “OVER” at the bottom of the form and continue on the back side.
2. **Comments** – This space is used to provide explanation on any part of the assessment that the evaluator believes needs to be explained. In the case where the road may be “posted” RESTRICTED USE, the evaluator would note the restrictions if they are not checked off in the recommendations section. If the road is to be “posted” UNSAFE, the reasons for that choice are provided here.

STATE OF CALIFORNIA SAFETY ASSESSMENT PROGRAM ROAD/HIGHWAY

Facility Name _____	SAP ID Nos. _____
Address _____	Other Reports _____
Co-City-Vic _____	No. Photos _____ No. Sketches _____
Mo/Day/Yr _____ / _____ / _____ Time _____ use 24 hr.	Ref. Dwgs. _____
Type of Disaster _____	Est. Damage % _____
	Facility Status <div style="border: 1px solid black; width: 150px; height: 30px; display: inline-block;"></div>

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None ☐ Recommended: Green ☐ Posted at this assessment: Yes ☐
Green ☐ Yellow ☐ No ☐
Yellow ☐ Red ☐
Red ☐

Existing barricades in position ☐

B. RECOMMENDATIONS

Monitor _____ <input type="radio"/>	Ok for emergency vehicles _____ <input type="radio"/>
Ok for public transportation _____ <input type="radio"/>	Ok for private vehicles _____ <input type="radio"/>
Ok for pedestrians _____ <input type="radio"/>	Ok for one-way traffic _____ <input type="radio"/>
Ok for two-way traffic _____ <input type="radio"/>	Install barricades _____ <input type="radio"/>
Use detour(s) _____ <input type="radio"/>	Aftershocks potentially dangerous to traffic _____ <input type="radio"/>
Traffic in danger due to adjacent unstable/unsound structure _____ <input type="radio"/>	

C. COMMENTS

DAMAGE OBSERVED (D.O.)

Damage Scale:	0 None (0%)	1 Slight (1-10%)	2-3-4 Moderate (11 - 40%)	5 Severe (41 - 60%)	6 Total (over 60%)	NA Not Applicable	NO Not Observed
---------------	-------------------	------------------------	---------------------------------	---------------------------	--------------------------	-------------------------	-----------------------

D. ROADBED

D.O.	Location	Extent
_____ Fills	_____	_____
_____ Cuts	_____	_____
_____ Subgrade	_____	_____
_____ Slip-outs	_____	_____
_____ Slides	_____	_____
_____ Washouts	_____	_____

E. PAVEMENTS

D.O. _____

_____ Longitudinal cracks

_____ Transverse cracks

_____ Vertical displacement

Amount _____

Side up (N, S, E, W) _____

Pavement type: ☐ AC ☐ PCC ☐ Other

Describe _____

F. TRAFFIC CONTROL FACILITIES

D.O. _____

_____ Condition

☐ Operating

☐ Critical regulatory signs standing

Exceptions and conditions: _____

G. UTILITIES

D.O. _____

_____ Drainage

_____ Gas lines

_____ Petroleum lines

_____ Underground power lines

_____ Aboveground power lines

_____ Sewers

_____ Water lines

_____ Other _____

H. OBSTRUCTION/HAZARDS

D.O. _____

_____ Bridges

_____ Buildings/structures

_____ Debris

_____ Joint poles

_____ Mud

_____ Power lines

_____ Rocks

_____ Trees

_____ Water

_____ Other _____

I. REMARKS _____

3. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.
4. **Sections D through H** – These are the individual components of the road that should be assessed. For each component, estimate the level of damage using the damage scale. For areas not seen use the "NO" (Not Observed) rating. Remember, as with buildings, you are not to perform destructive investigation. You will rate only what you can see by walking around and over the roadway. Work safely – do not get too close to the edges of slip-outs or other road section failures where a fall could cause injury.
5. **Section I – Remarks** – This section lets you expand in some detail the results of the assessment of the various components. As with the comments section, if there is not enough room, simply mark "OVER" at the bottom and continue on the back side of the form.

4.5.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended "posting." If it is determined that the road is so seriously damaged that it needs to be posted UNSAFE and removed from service, the jurisdiction representative with you should be told immediately. They, in turn, will contact either Public Works or the local Police Department to ensure the proper actions are taken. If you do not have a jurisdiction representative with you, use the list of contact numbers provided to you, and call the individual who assigned the road to you to report your findings and recommendations. In the case where recommendations are not time sensitive, wait until you return to your staging area to pass on your recommendations. Roads, like most lifeline systems or facilities, will not be physically posted. The placards are too small for motorists to safely see and understand what the placard says. Barricades are the most likely method to be used to close a damaged road.

4.6 Pipeline



Figure 4-5 Streambed Crossing

Pipelines can carry anything from fuel to water to sewage. For the purpose of post-disaster safety assessment, the pipelines most likely to be evaluated will be water and sewage, as they have the most significant impact on the recovery of the community. High and medium pressure natural gas pipelines, and liquid fuel lines can have devastating impacts on communities if they explode or catch fire. These failures are usually very quickly identified and will be the responsibility of the pipeline owner to stabilize (isolate) and repair.

How pipelines are evaluated will be up to the jurisdiction. In most cases, the evaluation team will be given a segment of the system to look at. Therefore, the team should also be prepared to evaluate other facilities that are a part of the system, such as pump stations and reservoirs. The evaluation of

buried pipelines will be problematic in that there is not much to see, and you will have to base your evaluation on surface conditions. For exposed pipelines, the evaluation becomes more straightforward. But, as in all of these evaluations, you will not be performing destructive investigations

The most pipeline damage occurs to brittle pipelines (such as cast iron or vitreous clay) buried in liquefiable soils. Some damage will occur due to shaking. Pipelines constructed of ductile materials such as steel or polyethylene (such as for natural gas distribution) are more flexible and will have fewer failures. Pipelines can fail as a result of shear, joint damage or separation, or can simply burst. For water systems, depending on the number of pipeline failures, entire areas of the system may lose pressure and become non-functional. In many cases, failures of pressurized pipelines, such as those carrying water, will result in water boiling out of the ground. Most sewer pipelines operate by gravity (i.e. are not pressurized). Immediate damage will only be evident if the sewer collapses, causing backup (and possible overflow) of sewage. In liquefiable soils, sewers and manholes will become buoyant, changing their vertical alignment, making them hydraulically inoperable. Identification of these types of failures will only be possible using specialized equipment.

4.6.1 Filling out the Pipeline Evaluation Form

A copy of the evaluation form can be found on the following page.

1. **Recommendations** – This section shows the typical types of recommendations that would apply to pipelines, though not necessarily the only ones. Upon completion of the assessment, your overall recommendations are noted here by checking the appropriate boxes. If the “Monitor” box is checked, make sure that you note in the comments the conditions that need to be monitored and the criteria. Also, include some form of threshold when another action should take place. For the other boxes, add information in the comments section when appropriate. If the “Divert Flow” box is checked, you should provide an explanation. If there is not enough room for all the comments, simply note “OVER” at the bottom of the form and continue on the back side.
2. **Comments** – This space is used to provide explanation on any part of the assessment that the evaluator believes needs to be explained. In the case where the pipeline may be posted RESTRICTED USE, the evaluator would note the restrictions if they are not checked off in the recommendations section. If the pipeline is to be posted UNSAFE, the reasons for that choice are provided here.
3. **Pipeline Description** – In this section of the evaluation form, the evaluator will describe the construction and materials of the pipeline along with the material carried. In the spaces where dimensions are requested, these can be either estimated or measured with a measuring tape.
4. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.

STATE OF CALIFORNIA SAFETY ASSESSMENT PROGRAM PIPELINE

<p>Facility Name _____</p> <p>Address _____</p> <p>Co-City-Vic _____</p> <p>Mo/Day/Yr ____/____/____ Time _____ use 24 hr.</p> <p>Type of Disaster _____</p>	<p>SAP ID Nos. _____</p> <p>Other Reports _____</p> <p>No. Photos _____ No. Sketches _____</p> <p>Ref. Dwgs. _____</p> <p>Est. Damage % _____</p> <p>Facility Status </p>
---	--

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None <input type="radio"/>	Recommended: Green <input type="radio"/>	Posted at this assessment: Yes <input type="radio"/>
Green <input type="radio"/>	Yellow <input type="radio"/>	No <input type="radio"/>
Yellow <input type="radio"/>	Red <input type="radio"/>	
Red <input type="radio"/>		

B. RECOMMENDATIONS

Monitor _____ <input type="radio"/>	Continue in service _____ <input type="radio"/>
Remove from service _____ <input type="radio"/>	Install temp. above-ground line _____ <input type="radio"/>
Provide temporary alternate service _____ <input type="radio"/>	Check water quality/safety _____ <input type="radio"/>
Unblock entrance _____ <input type="radio"/>	Divert flow _____ <input type="radio"/>
_____	_____
_____	_____
_____	_____

C. COMMENTS

D. PIPELINE DESCRIPTION

1. Type of pipeline: Pressure ☐ Gravity ☐ Storm Drain ☐
Water ☐ San. Sewer ☐ Other ☐ _____

2. Pipe nominal diameter: _____ 3. Proximity to water/sewer/gas line: _____

	AC	CI	CMP	DI	PVC	RC	STEEL	VC	WI	Other	Unknown
Bell & Spigot											
Butt											
Caulked											
Comp. Ring											
Riveted											
Welded											
Unknown											

4. Describe the failure mode:

- ☐ Circumferential crack
- ☐ Burst pipe barrel
- ☐ Sheared pipe barrel
- ☐ Sheared service connection
- ☐ Pulled joint
- ☐ Broken joint
- ☐ Other _____
- ☐ Liquefaction Describe _____

DAMAGE OBSERVED (D.O.)

Damage Scale: 0 None 1 Slight 2-3-4 Moderate 5 Severe 6 Total NA NA
(0%) (1-10%) (11 - 40%) (41 - 60%) (over 60%) Not Not
Applicable Observed

SURFACE OBSERVATIONS

- | | |
|---|-------------------------------------|
| D.O. | D.O. |
| E. _____ Ground surface disturbed | K. _____ Soffit damaged |
| F. _____ Visible leakage | L. _____ Invert displacement |
| G. _____ Service connection broken | M. _____ Horizontal displacement |
| H. _____ Headwall damaged | N. _____ Trash-rack blocked/damaged |
| I. _____ Endwall damaged | O. _____ Leakage at valves |
| J. _____ Manhole damaged | P. _____ Leakage continuing |
| | Q. _____ Leakage rates _____ |
| R. Nearest valve/MH (if less than 1/4 mile) _____ | |

S. Remarks

5. **Sections E through R** – These are typical conditions that show the pipeline is damaged. For each element estimate the level of damage using the damage scale. For areas not seen use the NO (Not Observed) rating. Remember, as with buildings, you are not to perform destructive investigation. You will rate only what you can see by walking around, over, and under the pipeline. If the pipeline is buried, look for conditions on the surface that will indicate that these types of damage have occurred. If none is observed, mark the line with NO. In item Q, if leakage is found make your best estimate on the leakage rate. In Section R, the closest manhole can be estimated or paced. Make sure that you indicate somewhere the direction to the nearest manhole.
6. **Remarks** – This section lets you expand in some detail the results of the assessment. As with the comments section, if there is not enough room, simply mark "OVER" at the bottom and continue on the back side of the form.

4.6.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended posting. If it is determined that the pipeline is so seriously damaged that it needs to be removed from service, the jurisdiction representative working with you should be told immediately, who, in turn, will contact Public Works to ensure the proper actions are taken. If you do not have a jurisdiction representative with you, use the list of contact numbers provided to you, and call the individual who assigned the pipeline to you to report your findings and recommendations. In the case where recommendations are not time sensitive, wait until you return to your staging area to pass on your recommendations.

4.7 Pump Station



Figure 6-6 Pump Station

Pump stations may or may not be assigned for evaluation separately. Many times, a segment of pipeline you are evaluating will include a pump station. Where the facility is located above ground in a building, also include a building evaluation to cover the structural and nonstructural components.

Pump stations are found with water, wastewater, natural gas (compressor stations), and liquid fuel pipelines. All but wastewater pump stations are usually at grade, and may have components as deep as 10 feet below grade. The most common type of damage will be loss of power, damage to the emergency power system, fallen electrical

and control cabinets, and damage to piping. Building damage is less likely unless the structures are unreinforced masonry. Wastewater pump stations may be many tens of feet deep and are often founded in liquefiable soils. If the soils liquefy, the pump stations can become buoyant, breaking connecting piping.

4.7.1 Filling out the Pipeline Evaluation Form

A copy of the evaluation form can be found on the following page.

STATE OF CALIFORNIA SAFETY ASSESSMENT PROGRAM PUMP STATION

Facility Name _____	SAP ID Nos. _____
Address _____	Other Reports _____
Co-City-Vic _____	No. Photos _____ No. Sketches _____
Mo/Day/Yr _____ / _____ / _____ Time _____ use 24 hr.	Ref. Dwgs. _____
Type of Disaster _____	Est. Damage % _____
	Facility Status <div style="border: 1px solid black; width: 150px; height: 30px; display: inline-block;"></div>

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None ☐ Recommended: Green ☐ Posted at this assessment: Yes ☐
Green ☐ Yellow ☐ No ☐
Yellow ☐ Red ☐
Red ☐

B. RECOMMENDATIONS

Monitor _____ <input type="radio"/>	Continue in service _____ <input type="radio"/>
Remove from service _____ <input type="radio"/>	Check pump-motor alignment _____ <input type="radio"/>
Brace structure before using _____ <input type="radio"/>	Recheck after power restored _____ <input type="radio"/>
Check filter basket _____ <input type="radio"/>	
_____	_____
_____	_____
_____	_____

C. COMMENTS

D. PUMP STATION DESCRIPTION

- ☐ Water ☐ Wastewater ☐ Sewage ☐ Other _____
- ☐ Wet Well
- ☐ Dry Well

	No. Motors				No. Operable				Str. Type	Buried	Above Grade
	Elect	Gas	Gasoline	Diesel	Elect.	Gas	Gasoline	Diesel			
Centrifugal									Concrete		
Reciprocal									Masonry		
Horizontal									Frame		
Vertical									Other		

- ☐ Building (Building Evaluation Attached ☐)

DAMAGE OBSERVED (D.O.)

Damage Scale: 0 1 2-3-4 5 6 NA NO
 None Slight Moderate Severe Total Not Not
 (0%) (1-10%) (11 - 40%) (41 - 60%) (over 60%) Applicable Observed

E. STRUCTURE

D.O.

- _____ Access
 _____ Crane runway
 _____ Fixed hoist
 _____ Floor
 _____ Fore bay
 _____ Foundation
 _____ Roof
 _____ Walls
 _____ Hatches

F. PUMPS

- _____ Anchors
 _____ Casing
 _____ Connected piping
 _____ Supports
 _____ Valves

G. MOTORS/ENGINES

D.O.

- _____ Anchors
 _____ Connected piping
 _____ Couplings to pumps
 _____ Power supply
 _____ Transformer(s)

H. CONTROLS

- _____ Internal power
 _____ Supports
 _____ Wiring
 _____ Valves

K. EXTERNAL PIPING

- | | Inlet | Outlet |
|---------|-----------------------|-----------------------|
| Piping | _____ | _____ |
| Leaked | <input type="radio"/> | <input type="radio"/> |
| Leaking | <input type="radio"/> | <input type="radio"/> |

I. EXTERNAL POWER

D.O.

- _____ Electrical continuity
 _____ Fuel lines
 _____ Fuel storage

J. AUXILIARY EQUIPMENT

- _____ Charts
 _____ Lighting, exterior
 _____ Lighting, interior
 _____ Meters & gauges
 _____ Overhead crane
 _____ Small diameter piping
 _____ Electrical Cabinets

Leakage rate, gpm _____

L. REMARKS

1. **Recommendations** – This section shows the typical types of recommendations that would apply to pump stations, though not necessarily the only ones. Blank space is provided to add recommendations that the assessment team feels are appropriate to the facility. Upon completion of the assessment, your overall recommendations are noted here by checking the appropriate boxes. If the “Monitor” box is checked, make sure that you note in the comments the conditions that need to be monitored and the criteria. Also, include some form of threshold when another action should take place. For the other boxes, add information in the comments section when appropriate. If the “Brace Structure” box is checked, you should provide an explanation and location. If there is not enough room for all the comments, simply note “OVER” at the bottom of the form and continue on the backside.
2. **Comments** – This space is used to provide explanation on any part of the assessment that the evaluator believes needs to be explained. In the case where the pump station may be posted RESTRICTED USE, the evaluator would note the restrictions if they are not checked off in the recommendations section. If the pump station is to be posted UNSAFE, the reasons for that choice are provided here. If the station is in an above-ground building, note that a building evaluation is a part of this overall assessment.
3. **Pump Station Description** – In this section the evaluator describes the type of pump, construction, and materials of the station.
4. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.
5. **Sections E through K** – These sections provide the assessment of the various components of the station. If the station is above ground and in a structure a small note in this section referencing the building assessment would be appropriate. For each element estimate the level of damage using the damage scale. For areas not seen use the “NO” (Not Observed) rating. Remember, as with buildings, you are not to perform destructive investigation. You will rate only what you can see by walking around the station. In item K, if leakage is found, make your best estimate on the leakage rate.
6. **Section L – Remarks** – This section lets you expand in some detail the results of the assessment. As with the comments section, if there is not enough room, simply mark “OVER” at the bottom and continue on the backside of the form.

4.7.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended posting. If it is determined that the pump station is so seriously damaged that it needs to be removed from service, the jurisdiction representative working with you should be told immediately, who, in turn, will contact Public Works to ensure the proper actions are taken. If you do not have a jurisdiction representative with you, use the list of contact numbers provided to you, and call the individual who assigned the pump station to you to report your findings and recommendations. In the case where recommendations are not time-sensitive, wait until you return to your staging area to pass on your recommendations. If the pump station is in an above-ground building and you have performed a building evaluation as well, make sure to post the building based on the recommendations of the building assessment. If the

building is posted RESTRICTED USE, list the restrictions in the space provided on the placard. If the building is to be posted UNSAFE, note the conditions leading to the unsafe posting.

4.8 Reservoir (Tanks)



(Photograph from the Steinbrugge Collection)

Figure 4-7 – Water Tank, Elephant's Foot

This section refers to “tanks” typically constructed of steel or concrete, rather than impounded waters with dams. Many jurisdictions around the state use water tanks for storing domestic water supplies, and water tanks are highly susceptible to damage from earthquakes. The potential is there to use these evaluations following other types of events or situations, but it will be earthquakes where they are most often used. These become very important components of a jurisdiction's infrastructure in times of emergency, especially when their main water supply has been disrupted. The water that is in these tanks will be needed for firefighting operations as well as for drinking water. Unanchored steel tanks will uplift, breaking connecting piping. When uplift becomes more severe, the tank wall will wrinkle when the tank slams back down, commonly referred to as elephant's foot buckling. In severe cases, the wall-floor seam can burst. Sloshing water can damage the roof, although this is not likely to result in loss of service.

The most significant vulnerability to wire or cable-wrapped concrete tanks is failure of the wrapping as a result of corrosion or inadequate design. Older tanks can theoretically slide off their floor slab foundations, although this has never been documented. Roofs are also vulnerable.

4.8.1 Filling out the Reservoir Evaluation Form

Two types of reservoirs are included in this evaluation form: steel, and prestressed concrete. The evaluation team should immediately define which type of reservoir you will be evaluating and discard the form for the other type. For any part of this form where you are unsure, either note the item as NO (Not Observed) or indicate unsure.

A copy of the evaluation form can be found on the following page.

1. **Recommendations** – This section shows the typical types of recommendations that would apply to pump stations, though not necessarily the only ones. Blank spaces are provided to add recommendations that the assessment team feels are appropriate to the facility. Upon completion of the assessment, your overall recommendations are noted here by checking the appropriate boxes. If the “Monitor” box is checked, make sure that you note in the comments the conditions that need to be monitored and the criteria. Also, include some form of threshold when another action should take place. For the other boxes, add information in the comments section when appropriate. If the “Brace Structure” box is checked, you should provide an explanation and location. If there is not enough room for all the comments, simply note “OVER” at the bottom of the form and continue on the back side.

STATE OF CALIFORNIA SAFETY ASSESSMENT PROGRAM RESERVOIR

Facility Name _____	SAP ID Nos. _____
Address _____	Other Reports _____
Co-City-Vic _____	No. Photos _____ No. Sketches _____
Mo/Day/Yr _____ / _____ / _____ Time _____ use 24 hr.	Ref. Dwgs. _____
Type of Disaster _____	Est. Damage % _____
	Facility Status <div style="border: 1px solid black; width: 150px; height: 30px; display: inline-block;"></div>

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:	None <input type="radio"/>	Recommended:	Green <input type="radio"/>	Posted at this assessment:	Yes <input type="radio"/>
	Green <input type="radio"/>		Yellow <input type="radio"/>		No <input type="radio"/>
	Yellow <input type="radio"/>		Red <input type="radio"/>		
	Red <input type="radio"/>				

B. RECOMMENDATIONS

Monitor _____ <input type="radio"/>	Continue in service, repair ASAP _____ <input type="radio"/>
Remove from service _____ <input type="radio"/>	Drain and repair _____ <input type="radio"/>
Continue in service _____ <input type="radio"/>	Lower water level and continue service _____ <input type="radio"/>
.	_____ ft
_____	_____
_____	_____
_____	_____

C. COMMENTS _____

STEEL RESERVOIR

D. RESERVOIR DESCRIPTION

Capacity _____ MG Wall Height _____ ft O/S Diameter _____ ft

Roof Type ☐ Wood ☐ Steel ☐ Flat ☐ Conical ☐ Knuckled Edge

Shell ☐ Welded ☐ Bolted ☐ Riveted

Floor support ☐ Footing ring ☐ Oiled sand ☐ A.C. ☐ Other _____

Footing ☐ Concrete ring ☐ Other _____ ☐ None

Pipe connection ☐ Rigid ☐ Flexible

Anchorage to foundation _____ Dia. _____ Spacing

DAMAGE OBSERVED (D.O.)

Damage Scale:	0	1	2-3-4	5	6	NA	NO
	None	Slight	Moderate	Severe	Total	Not	Not
	(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

E. SHELL

D.O.

_____ Elephant's foot

a. Height _____ ft

b. Circumferential extent _____ ft

_____ Other buckling

_____ Horizontal joints broken

_____ Vertical joints broken

_____ Plate split

_____ Seismic anchors

_____ Rocking of reservoir evidenced

_____ Sliding of reservoir evidenced

_____ Leaks evident. Rate _____ gpm

_____ Unexplained wet spots on adjacent ground

_____ Shell penetrations damaged

_____ Other attachments to shell damaged

_____ Pipe Connections to Tank

F. VALVE PIT

D.O.

_____ Access

_____ Control Piping

_____ Gauges

_____ Hatches

_____ Inlet-outlet piping

_____ Pit flooded

_____ Roof

_____ Walls

_____ Charts

_____ Valving

G. _____ Roof

H. _____ Footing

I. _____ Floor

J. _____ Aboveground Piping

K. _____ Underground Piping

L. REMARKS

PRESTRESSED CONCRETE RESERVOIR

M. RESERVOIR DESCRIPTION:

Wire or Strand Wrapped	Buttress Type using individual Tendons, usually inside wall	Bar Tendons on Tank Surface
TENDONS:		
<input type="radio"/> 220 ksi - 0.142" or 0.172" dia	<input type="radio"/> Strands <input type="radio"/> Wires <input type="radio"/> Bars	<input type="radio"/> Bars with prop. couplers
<input type="radio"/> 270 ksi - 3/8" dia		
WALL CONSTRUCTION:		
<input type="radio"/> Cast-in-place	<input type="radio"/> Cast-in-place	<input type="radio"/> Cast-in-place
<input type="radio"/> Shotcrete	<input type="radio"/> Precast	<input type="radio"/> Shotcrete
<input type="radio"/> Shotcrete w/ steel diaphragm		
<input type="radio"/> Precast		
<input type="radio"/> Precast w/ steel diaphragm		
TENDON PROTECTION SYSTEMS:		
<input type="radio"/> Shotcrete	<input type="radio"/> Corrosion inhibiting grease	<input type="radio"/> Galvanizing protected by plastic sheath
	<input type="radio"/> Grout	
Tank Restraints	<input type="radio"/> Seismic cables	<input type="radio"/> Curb (restraining sliding)
Capacity _____ MG	Wall height _____ ft	O/S diameter _____ ft
Roof Type: <input type="radio"/> Flat	<input type="radio"/> Dome	Exposed <input type="radio"/> Fill depth _____
		Surface usage _____
	<input type="radio"/> Yes <input type="radio"/> No	

DAMAGE OBSERVED (D.O.)

	0	1	2-3-4	5	6	NA	NO
Damage Scale:	None	Slight	Moderate	Severe	Total	Not	Not
	(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

N. SHELL

- D.O.
- _____ Shell or shotcrete cracked
 - _____ Vertical cracks more than 2 feet long
 - _____ Unexplained excessive loss of contents
 - _____ Bulging observable
 - _____ Visible construction joints
 - _____ Wall leaking
 - _____ Wet spots
 - _____ Spouts
 - _____ Horizontal cracks more than 25% of perimeter
 - _____ Corrosion at horizontal cracks
 - _____ Shotcrete delaminated at cracks
 - _____ Attachments to shell loose
 - _____ Leaks @ rust stains
 - _____ Major leaks at shell/foundation joint
 - _____ Unexplained wet spots on adjacent ground
 - _____ Corrosion at manholes/other penetrations

O. HORIZONTAL PRESTRESSING

- D.O.
1. Wrapping:
 - _____ Corrosion
 - _____ Corrosion at horizontal cracks
 2. Individual tendons:
 - _____ Corrosion products
 - _____ Leaks @ tendon locations
 - _____ Leaks @ tendon anchorages
 - _____ Tendon anchorage distressed
 - _____ Tendon anchorage disrupted/loose
 - _____ Cracking in vicinity of tendon anchorage
 - _____ Tendon location visually observable
 - _____ Discoloration of concrete in line w/tendons
 3. Bar tendons on surface:
 - _____ Tendons failed
 - _____ Tendons sound loose
 - _____ Evidence of rust

[illegible]

2. **Comments** – This space is used to provide explanation on any part of the assessment that the evaluator believes needs to be explained. In the case where the pump station may be posted RESTRICTED USE, the evaluator would note the restrictions, if they are not checked off in the recommendations section. If the pump station is to be posted UNSAFE, the reasons for that choice are provided here. If the station is in an above-ground building, note that a building evaluation is a part of this overall assessment.
3. **Section D – Description** – This section is used only if the reservoir is of steel construction. In this section the evaluator describes in a fair amount of detail the construction of the steel reservoir. The capacity, height, and diameter should be estimated.
4. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.
5. **Sections E through K** – These sections provide the assessment of the various components of the reservoir. Areas where rocking or sliding are noted with direction and distance should be provided in the remarks section. For each element, estimate the level of damage using the damage scale. For areas not seen, use the NO (Not Observed) rating. Remember, as with buildings, you are not to perform destructive investigation. You will rate only what you can see by walking around the station. At the bottom of the page, estimate the leakage rate.
6. **Section L – Remarks** – This section lets you expand in some detail the results of the assessment. As with the comments section, if there is not enough room, simply mark OVER at the bottom and continue on the backside of the form.
7. **Section M – Description** – This part of the form is used only if the reservoir is of precast concrete construction. In this section the evaluator describes in a fair amount of detail the construction of the reservoir. The capacity, height, and diameter should be estimated. For the size and strength of the tendons provide the information only if you know. This information can be obtained from drawings if they are available.
8. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluator's use of the scales is based strictly on their professional judgment.
9. **Sections N through T** – These sections provide the assessment of the various components of the reservoir. Areas where displacement is noted should be discussed in the remarks section. For each element, estimate the level of damage using the damage scale. For areas not seen, use the NO (Not Observed) rating. Remember, as with buildings, you are not to perform destructive investigation. You will rate only what you can see by walking around the station. At the bottom of the page estimate the leakage rate.
10. **Section U – Remarks** – This section lets you expand in some detail the results of the assessment. As with the comments section, if there is not enough room, simply mark "OVER" at the bottom and continue on the back side of the form.

4.8.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended posting. If it is determined that the reservoir is so seriously damaged that it needs to be removed from service, the jurisdiction representative working with you should be told immediately, who, in turn, will contact Public Works to ensure the proper actions are taken. If you do not have a jurisdiction representative with you, use the list of contact numbers provided to you, and call the individual who assigned the reservoir to you to report your findings and recommendations. In the case where recommendations are not time-sensitive, wait until you return to your staging area to pass on your recommendations.

4.9 Wastewater Treatment Plants

Wastewater treatment plants are complex systems made up of many components and systems. Components include buried and above grade pipe, cast-in-placed concrete basins and utilidors (galleries), buildings, chemical, gas, piping, and electrical systems. You should be prepared with building evaluation forms to do a complete assessment of the facility. In evaluating the operation of the treatment plant, it will become easy to forget that you are doing a detailed evaluation, not an engineering evaluation. You will not be doing any destructive investigation. Your goal is to recommend whether or not the facility should remain in operation. The operators will perform any testing of materials or addition of chemicals in accordance with their standard operating procedures and/or state and local standards.

Each category of components has their own damage mechanisms. All types of components have been damaged as a result of liquefaction, settlement, and lateral spreading. Sewer lines have broken off and concrete basins and buildings settled. Expansion joints in concrete basins have failed, allowing sewage to drain into utilidors. Utilidors have flooded as a result of broken piping, also causing secondary damage when electrical equipment is submerged. Baffles in large basins have broken as a result of sloshing sewage. Treatment plant chemical storage and piping systems have been damaged, with gaseous chlorine being potentially the most dangerous chemical. Sludge digesters contain sludge and sludge gas that is explosive. Guides have broken off floating digester roofs, allowing gas to escape. Buildings can be damaged, and unanchored electrical equipment can overturn.

From a systems perspective, the goal is to keep as much of the plant in operation as possible. For example, it would be desirable as a minimum to maintain operation of the headworks, primary sedimentation basins, and chlorine disinfection system, even if the secondary or tertiary systems were heavily damaged and not operational.

STATE OF CALIFORNIA SAFETY ASSESSMENT PROGRAM TREATMENT PLANT (WASTEWATER)

Facility Name _____ Address _____ Co-City-Vic _____ Mo/Day/Yr ____/____/____ Time _____ <div style="text-align: right; font-size: small;">use 24 hr.</div> Type of Disaster _____	SAP ID Nos. _____ Other Reports _____ No. Photos ____ No. Sketches ____ Ref. Dwgs. _____ Est. Damage % _____ Facility Status
---	---

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing:	None	<input type="radio"/>	Recommended:	Green	<input type="radio"/>	Posted at this assessment:	Yes	<input type="radio"/>
	Green	<input type="radio"/>		Yellow	<input type="radio"/>		No	<input type="radio"/>
	Yellow	<input type="radio"/>		Red	<input type="radio"/>			
	Red	<input type="radio"/>						

B. RECOMMENDATIONS

Monitor _____ <input type="radio"/>	Continue in service _____ <input type="radio"/>
Remove from service _____ <input type="radio"/>	Check effluent quality/safety _____ <input type="radio"/>
Chlorinate and by-pass _____ <input type="radio"/>	
_____	_____
_____	_____

C. COMMENTS:

[illegible]

Check: Electrical power (control panel, emergency generator)
 Telemetry
 Disinfection process (chemical containers, feeder, piping)
 Broken pipes, flooding, leaking
 Chemical feed (spills)
 Unit Processes

OBSERVATIONS

RAW SEWAGE

SCREENING/GRINDING

INFLUENT PUMPING

GRIT REMOVAL

PRIMARY TREATMENT

SECONDARY TREATMENT

TERTIARY TREATMENT

QUATERNARY TREATMENT

EFFLUENT DISINFECTION

SOLIDS DIGESTION

SOLIDS DEWATERING

SOLIDS DISPOSAL

4.9.1 Filling out the Wastewater Treatment Plant Evaluation Form

A copy of the evaluation form can be found on the following page.

1. **Recommendations** – This section shows the typical types of recommendations that would apply to wastewater treatment plants, though not necessarily the only ones. Blank spaces are provided to add recommendations that the assessment team feels are appropriate to the facility. Upon completion of the assessment, your overall recommendations are noted here by checking the appropriate boxes. If the "Monitor" box is checked, make sure that you note in the comments the conditions that need to be monitored and the criteria. Also, include some form of threshold when another action should take place. For the other boxes, add information in the comments section when appropriate. If you check the "Chlorinate and by-pass" or "Check effluent quality/safety" boxes, you are sending a message to the operator that you are recommending this be done. Remember, this is only a recommendation, and the operators will follow their standard procedures. If there is not enough room for all the comments, simply note "OVER" at the bottom of the form and continue on the back side.
2. **Comments** – This space is used to provide explanation on any part of the assessment that the team believes needs to be explained. In the case where the plant may be posted RESTRICTED USE, the team will note the restrictions if they are not checked off in the recommendations section. If the plant is to be posted UNSAFE, the reasons for that choice are provided here.
3. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluators' use of the scales is based strictly on their professional judgment.
4. **Sections D through E** – These sections provide the assessment of the various structural, mechanical, and electrical components of the plant. For each element estimate the level of damage using the damage scale. For areas not seen use the "NO" (Not Observed) rating. Remember, as with buildings, you are not to perform destructive investigation. You will rate only what you can see by walking around the plant. Provide the information for Section E only if you have access to the information. If you have no access to the information, note that the information is Not Available. Do not note "NA" as that states the section is Not Applicable.
5. **Section F - Tributary Gravity Sewer System** – This section allows the team to summarize their assessment of the condition of the gravity sewer system. This should be a brief statement, as you are not performing an engineering evaluation. However, you can note in this section information you have observed about the system.
6. **Last Page** – This section records your observations regarding overall plant operation in dealing with these processes. At the top of the page is a checklist to help you in performing the evaluation.

**STATE OF CALIFORNIA
SAFETY ASSESSMENT PROGRAM
TREATMENT PLANT
(WATER)**

<p>Facility Name _____</p> <p>Address _____</p> <p>Co-City-Vic _____</p> <p>Mo/Day/Yr ____/____/____ Time _____ use 24 hr.</p> <p>Type of Disaster _____</p>	<p>SAP ID Nos. _____</p> <p>Other Reports _____</p> <p>No. Photos ____ No. Sketches ____</p> <p>Ref. Dwgs. _____</p> <p>Est. Damage % _____</p> <p>Facility Status </p>
---	--

SAFETY INSTRUCTIONS: The possibility of toxic gases in confined spaces or of fuel leaks should be recognized as a potential hazard.

CAUTION: The primary purpose of the report is to advise of the condition of the facility for immediate continued use/occupancy. REINSPECTION OF THE FACILITY IS RECOMMENDED. AFTERSHOCKS MAY CAUSE DAMAGE THAT REQUIRES REINSPECTION. The conclusions reached by engineers who re-examine the facility later should take precedence. The assessment team will not render further advice in the event of conflict of engineering recommendations.

A. CONDITION:

Existing: None <input type="radio"/>	Recommended: Green <input type="radio"/>	Posted at this assessment: Yes <input type="radio"/>
Green <input type="radio"/>	Yellow <input type="radio"/>	No <input type="radio"/>
Yellow <input type="radio"/>	Red <input type="radio"/>	
Red <input type="radio"/>		

B. RECOMMENDATIONS

Monitor _____ <input type="radio"/>	Continue in service _____ <input type="radio"/>
Remove from service _____ <input type="radio"/>	Check effluent quality/safety _____ <input type="radio"/>
Chlorinate and by-pass _____ <input type="radio"/>	
_____	_____
_____	_____

C. COMMENTS:

DAMAGE OBSERVED (D.O.)

	0	1	2-3-4	5	6	NA	NO
Damage Scale:	None	Slight	Moderate	Severe	Total	Not	Not
	(0%)	(1-10%)	(11 - 40%)	(41 - 60%)	(over 60%)	Applicable	Observed

D. PRETREATMENT

D.O.

- _____ Raw water channels
- _____ Aerators
- _____ Rapid mix
- _____ Flocculation
 - _____ basins
 - _____ baffles
 - _____ paddles
 - _____ scrapers
- _____ Sedimentation
 - _____ basin
 - _____ troughs
 - _____ scrapers

E. FILTRATION

- _____ Structure
- _____ Troughs
- _____ Beds
- _____ Backwash system
- _____ Surface wash system

F. CHEMICAL TREATMENT

- _____ Chlorine piping
- _____ Chlorine cylinders
- _____ Chlorine feeders
- _____ Other chemical piping
- _____ Other chemical feeders
- _____ Other chemical storage

G. CONTROL SYSTEMS

- _____ Mechanical
- _____ Electrical
- _____ Pneumatic
- _____ Hydraulic
- _____ Manual
- _____ Automatic

H. HEAD HOUSE

D.O.

- _____ Bearing walls
- _____ Nonbearing walls
- _____ Frame (general condition)
- _____ Structural members
 - _____ Structural connections
- _____ Roof
- _____ Floors
- _____ Stairs
- _____ Elevators
- _____ Glass
- _____ Mechanical equipment
- _____ Electrical equipment
- _____ Filter gallery
 - _____ Piping
 - _____ Pipe gallery

I. CLEARWALL

- _____ Tank-type (use Reservoir Assessment Form)
- _____ Containment structure
- _____ Influent piping
- _____ Effluent piping

J. WASHWATER RECLAMATION

- _____ Settling basin
- _____ Mechanical equipment
- _____ Electrical equipment
- _____ Piping
- _____ Detention basin
- _____ Sludge discharge

K. REMARKS

Check: Electrical power (control panel, emergency generator)
 Telemetry
 Disinfection process (chemical containers, feeder, piping)
 Broken pipes, flooding, leaking
 Chemical feed (spills)
 Unit Processes

OBSERVATIONS

RAW WATER	<hr/> <hr/>
PRECHLORINATION	<hr/> <hr/>
AERATION	<hr/> <hr/>
RAPID MIX	<hr/> <hr/>
FLOCCULATION	<hr/> <hr/>
SEDIMENTATION	<hr/> <hr/>
FILTRATION	<hr/> <hr/>
DISINFECTION	<hr/> <hr/>
FLUORIDATION	<hr/> <hr/>
CLEARWELL	<hr/> <hr/>
DISTRIBUTION SYSTEM	<hr/> <hr/>

4.9.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended "posting." If it is determined that the plant is so seriously damaged that it needs to be posted UNSAFE and removed from service, the jurisdiction representative with you should be told immediately. They, in turn, will contact either Public Works or notify the plant operator to ensure the proper actions are taken. If you do not have a jurisdiction representative with you, use the list of contact numbers provided to you, and call the individual who assigned the wastewater treatment plant to you to report your findings and recommendations. In the case where recommendations are not time sensitive, wait until you return to your staging area to pass on your recommendations.

If you have performed building evaluations at the facility, make sure to post the buildings based on the recommendations of the building assessment. You should have a building assessment form for each building evaluated. If the building(s) is posted RESTRICTED USE, list the restrictions in the space provided on the placard. If the building(s) is to be posted UNSAFE, note the conditions leading to the unsafe posting.

4.10 Water Treatment Plants

The evaluation of water treatment plants will be similar to that of wastewater treatment plants. You should be prepared with building evaluation forms to do a complete assessment of the facility. In evaluating the operation of the treatment plant it will become easy to forget that you are doing a detailed evaluation, not an engineering evaluation. You will not be doing any destructive investigation. Your goal is to recommend whether or not the facility should remain in operation. The operators will perform any testing of materials or addition of chemicals in accordance with their standard operating procedures and/or state and local standards.

The type of damage that has been experienced by water treatment plants is similar to wastewater plants, although less severe. Water treatment plants tend to be constructed on higher ground, away from liquefiable soil. Damage to baffles due to sloshing water inside basins is common. Unanchored equipment will slide and/or topple. The treatment plant concrete basins, if founded on competent soils, are robust, so limited damage is expected. Water treatment plants also have many treatment chemicals, although many have eliminated gaseous chlorine because it is so dangerous. Of course, unanchored equipment is vulnerable to damage from lateral forces.

4.10.1 Filling out the Wastewater Treatment Plant Evaluation Form

A copy of the evaluation form can be found on the following page.

Recommendations – This section shows the typical types of recommendations that would apply to wastewater treatment plants, though not necessarily the only ones. Blank spaces are provided to add recommendations that the assessment team feels are appropriate to the facility. Upon completion of the assessment, your overall recommendations are noted here by checking the appropriate boxes. If the monitor box is checked, make sure that you note in the comments the conditions that need to be monitored and the criteria. Also, include some form of threshold when another action should take place. For the other boxes, add information in the comments section when appropriate. If you check the "Chlorinate and by-pass" or "Check effluent quality/safety" boxes, you are sending a message to the operator that you are recommending this be done. Remember, this is only a recommendation and the

operators will follow their standard procedures. If there is not enough room for all the comments, simply note "OVER" at the bottom of the form and continue on the back side.

2. **Comments** – This space is used to provide explanation on any part of the assessment that the team believes needs to be explained. In the case where the plant may be posted RESTRICTED USE, the team will note the restrictions if they are not checked off in the "Recommendations" section. If the plant is to be posted UNSAFE, the reasons for that choice are provided here.
3. **Damage Observation (DO)** – The damage scale is a scale from 0 to 6 used to rate the damages that are found. It will be used in the assessment of the various components of the facility. The damage scale gives the evaluator and the jurisdiction a tool to indicate the level of damage. However, the evaluators' use of the scales is based strictly on their professional judgment.
4. **Sections D through J** – These are the individual components of the plant that should be assessed. For each component estimate the level of damage using the damage scale. For areas not seen use the "NO" (Not Observed) rating. Remember, as with buildings, you are not to perform destructive investigation. You will rate only what you can see by walking around the plant.
5. **Section K – Remarks** - This section lets you expand in some detail the results of the assessment of the various components. As with the comments section, if there is not enough room, simply mark "OVER" at the bottom and continue on the back side of the form.
6. **Last Page** – This section records your observations regarding overall plant operation in dealing with these processes. At the top of the page is a checklist to help you in performing the evaluation.

4.10.2 Posting

Upon completion of the assessment, the team will arrive at a decision on the recommended "posting." If it is determined that the plant is so seriously damaged that it needs to be posted UNSAFE and removed from service, the jurisdiction representative with you should be told immediately. They, in turn, will contact either Public Works or notify the plant operator to ensure the proper actions are taken. If you do not have a jurisdiction representative with you, use the list of contact numbers provided to you, and call the individual who assigned the water treatment plant to you to report your findings and recommendations. In the case where recommendations are not time sensitive, wait until you return to your staging area to pass on your recommendations.

If you have performed building evaluations at the facility, make sure to post the buildings based on the recommendations of the building assessment. You should have a building assessment form for each building evaluated. If the building(s) is posted RESTRICTED USE, list the restrictions in the space provided on the placard. If the building(s) is to be posted UNSAFE, note the conditions leading to the unsafe posting.